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Gas Journal

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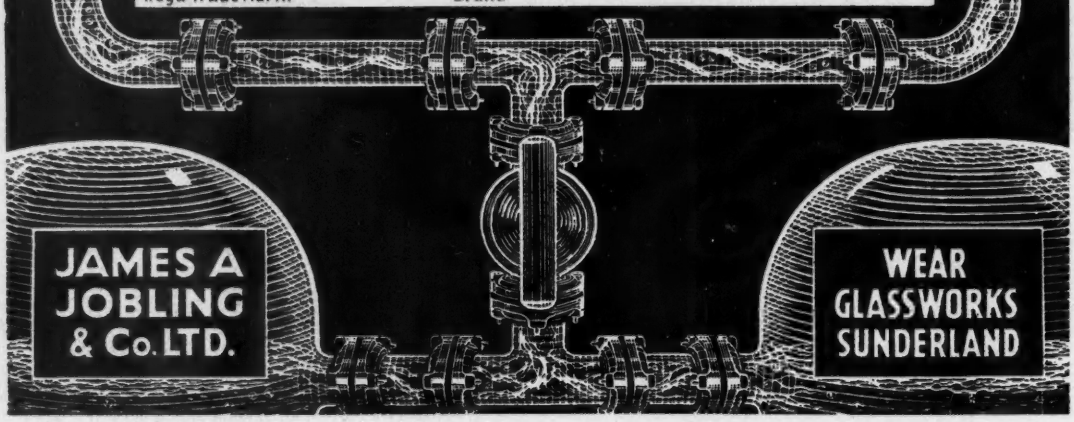

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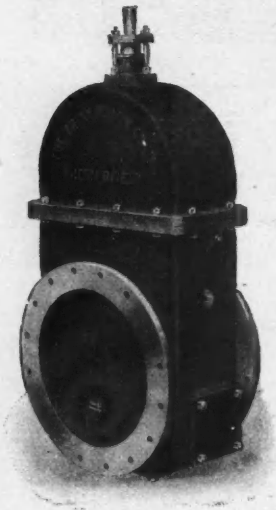

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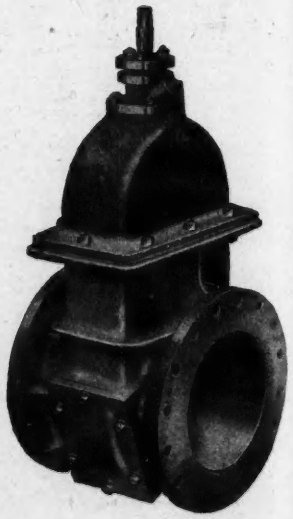

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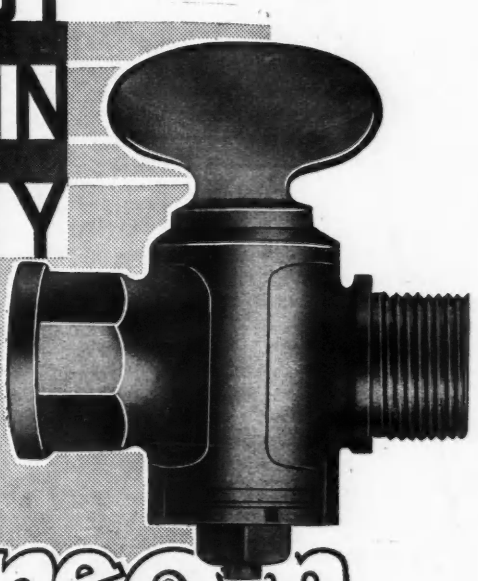

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P.2

GAS JOURNAL, MAR. 10, 1943

VOL. 241 95th YEAR No. 4164

EDITORIAL NOTES

SALARIES

WE think we are right in saying that many undertakings in the Gas Industry have over many years exhibited a careless optimism concerning the salaries they have been prepared to offer their engineers and managers and their chief assistants. The multiplicity of small undertakings with limited financial resources has not helped matters. It is manifestly absurd to expect to gain the services of the good engineer, good distribution man, good secretary, good chemist all rolled into one at a cost of five or six pounds a week (we are thinking of conditions obtaining pre-war). But the optimism largely persisted; nor was it confined to the small undertaking, and it was especially pronounced in those undertakings under municipal control. In several quarters there was lack of appreciation of the responsibilities placed on the officials, and insufficient practical recognition that, as a very broad generalization, one gets what one pays for. All of which was hardly conducive to an avowed desire and admitted need for attracting to the Industry a vigorous and potentially capable personnel. We have been writing in the past tense, the while we are fully aware that the tone of the Industry's professional money market is not hard. However, we discern signs of improvement.

We believe that the national importance of the Gas Industry is not widely understood outside the Industry, and that one of the reasons for faulty interpretation of its importance lies in the disparity in many instances between the salaries offered by the Industry to its responsible executive and technical personnel and the executive and technical responsibilities involved. The problem is complicated; its satisfactory solution, which, at best, must be in the nature of a compromise, is not easy. But this we would emphasize—the solution is being actively sought, and we have hopes of a better understanding. Certain advertisements which of late have appeared in our columns substantiate this hope and the recognition in part of the validity of a national scale of salaries of those professionally qualified for responsible work in the Industry—a national scale, moreover, covering both company and municipally owned undertakings. We know that much thought and much unselfish work have been directed and continue to be directed towards a flexible agreement whereby an accepted minimum scale will not be regarded as a maximum scale. It seems to us important that agreement on a minimum scale should not be automatically followed by a professional regimentation of income, and as a further consequence the whittling-away of incentive.

We think that headway is being made on the issues of the salaries of engineers and managers and their assistants in a practical way. We have grounds for this opinion, and while we see nothing amiss in the free expression of views, we can only regard with misgiving further movements at the present juncture armed with lively arguments amid sympathetic audiences but with likely chance, not of advancing, but of retarding the flexible solution which seems to us to be on the way. Turning from the general to the particular, we received a report recently of an Address given to a Junior Gas Association. Part of it dealt with kinematic viscosity and part with the "direct relationship between the statutory prices for gas and wages and salaries schemes." The author's contention was that the men who have to bring about the economic improvements in the supply of gas are denied rights which are at present given without a murmur to wages and dividends. And he explained that he had recently been requested to undertake the organization of a body to take speedy action in the matter, and said he had acquiesced to the request. His statement in this regard was cryptic—so cryptic that we shall attempt in no way to pre-judge the outcome of such a proposal, though we do seriously question the wisdom of the suggestion for it. We shall no doubt soon know something about its sponsors and those seniors and juniors who may feel inclined to support it. Our own support is for those who have worked and are working for practical results, and whose achievements are, we think, beginning to bear monetary fruit and a better recognition of the status of the gas engineer and manager and his more immediate staff.

FUTURE DOMESTIC HEATING

WE have suggested before that there is need for a wider education towards a balanced outlook on the fuel problem as a whole—an outlook which will alone make possible the best use of the various forms of heat energy in both national and community interests. We become more convinced of this need if in the future we are to apply in a rational manner the fuel resources—solid, gaseous, and in the form of electricity—available in this country, and to apply them so as to conserve the basic material, coal, and get rid of the social evil of smoke. We return to the subject in the light of the results of yet another survey on post-war housing which have been published—of the replies to yet another questionnaire on What would you like? lines. The results are set out by the Standing Joint Committee of Working Women's Organizations in a memorandum submitted to the Sub-Committee on Design of Dwellings of the Central Housing Advisory Committee to the Ministry of Health. We dealt previously ("JOURNAL" of Jan. 27) with a report submitted to the same body by the Women's Advisory Housing Council. There are sweeping statements and assumptions in the present memorandum which call for serious thought.

The Joint Committee of Working Women's Organizations, which was formed in 1916, recently circulated a series of questions to ascertain the views of women on the planning and equipment of post-war houses. The number of women covered by the written replies was about 3,000; the report is based on these replies and also on reports from conferences of women throughout the country. "We realize," runs the report, "the importance of securing the views of a large number of women individually,

but we emphasize the importance of collective views expressed by groups of women after detailed discussion at meetings"; and it goes on to say, in regard to the provision of central hot water systems, that many women would have answered the question differently if they had previously been addressed at meetings and systems in use in other countries had been explained to them. This interests us very much and in a way it is rather disturbing. We can visualize gatherings of working women being addressed by special pleaders of antagonistic camps and then sent home, as it were, to be good girls and write out the answers which find favour with the special pleader, who may or may not have political motives, and who may tackle his or her section of the subject either on a narrow basis or with the balanced outlook of which we have spoken. The system could so easily lend itself to competitive persuasion such as to invalidate the findings of the innocent questionnaire.

Our comments on the report are confined only to the question of the provision of heat for the homes of the future. The Joint Committee suggests that the method of "carrying water and steam by insulated underground pipes to houses, from a central generating system, should be carefully considered and developed as far as possible in post-war building schemes." It adds that women are eager to see the system tried. On the other hand, the modern slow combustion stove has strong appeal, and "would probably be the most satisfactory method, in many areas, of providing heating and hot water for the home." But wait a minute. "The popularity of the coal fire for the main living room is evident in every area. The largest minority which favours other methods is in the London area—10% electricity, *1% gas.*" Our italics. For the second living room we learn that opinion is divided between coal and electric fires, with gas fires an also ran. For bedrooms, the majority of women in every area want electricity. For the heating of water there is a variety of preferences. "In many urban areas an electric heater is the first choice. . . . Very few women want gas." As for cooking, "electricity is the first choice." No mention whatever is made of gas. There seems to us something difficult to understand about this report.

We arrive at the Committee's summing-up that the demand for electricity for domestic purposes from every area is one that must be met in post-war planning. Women in the country as well as town are almost unanimous in wanting electricity. There follows the sweeping statement—an extraordinary statement in a report of the nature—that "Mr. Therm has fewer and fewer friends. In villages and rural areas where there is as yet neither electricity nor gas, women want to by-pass the gas stage and go direct to electricity." What motivated this remark about Mr. Therm we do not know, but the statement displays complete ignorance of the fuel problem as a whole and lack of appreciation that the nation is not destined to arrive at electricity *via* a "gas stage," which if we read the report aright, is an inferior and intermediate method of treating coal. Gas, smokeless solid fuel, and electricity have their parts to play post-war, and the future will provide the answer to any question such as, Is the Gas Industry really necessary? But we repeat our suggestion that there is need for a wider education towards a balanced outlook on the fuel problem as a whole—in the interests of the nation and not of any one particular section of it. The report of the Standing Joint Committee of Working Women's Organizations—in its lighthearted and lightheaded comments on the Gas Industry—does not exemplify the right approach to a balanced outlook.

Electricity and Public Ownership

Last week the London and Home Counties Joint Electricity Authority approved a report in which its General Purposes Committee recommends the transfer to public ownership of all electricity undertakings in the Authority's district. The report states that by bringing all the undertakings into the ownership of one competent public authority representative in its constitution, and by reconstructing the capital finances of the industry, the way is wide open to bring about all the reforms that for so many years have been regarded as necessary if the industry is properly to carry out its real function—in particular "the reforms upon which the Scott Committee in its recent report recommended that the Electricity Commissioners should be instructed to prepare schemes, and to which Sir William Jowitt and the Minister of Works and Planning referred in Parliament within the past few months, and also the reforms mentioned in the Report of the Committee on Electricity Distribution of 1936." The London and Home Counties Electricity District is described as by far the largest urban area in the country and providing, taken as a whole, satisfactory conditions for the development of the largest and finest electricity supply service in the world. Unification of electricity services throughout the district is called for, and there are no fewer than 57 separate undertakings. It is understood that the scheme applies the principles of reorganization adopted for the metropolitan water supply and transport services, extending to the whole of the authority's district what it has already accomplished in a part of the district measuring about 200 square miles by voluntary agreement supported by the prospective use of compulsory powers.

The "appointed day" of transfer, it is urged, should be the earliest possible date, if practicable before the end of the war, so as to enable an improved organization to line up as a single concentrated organization and take its part as an essential feature of national planning. Quoting from *The Times* of March 6, "following the accepted lines of public policy, the new authority would develop a much improved service; and the availability of supply, fittings, and apparatus throughout the district at rates which the poorest could afford would be the industry's great contribution to post-war planning. In the view of the authority the scheme might be applied nationally with comparatively slight modifications."

The Coal Situation

The danger of a serious coal shortage has now passed. Safety has been ensured mainly by the economy of coal consumers in industry and the home, assisted by the mildness of the weather and the freedom of transport from interruption. Coal production from the mines has been lower than in the preceding winter, and the latest return of the Ministry of Fuel, which is for the four weeks ended Feb. 20, shows that the technical measures to increase output and the increase in the number of mine workers have not raised the tonnage to the level of the corresponding period a year ago, when anxiety was becoming acute.

Personal

Mr. A. G. ARNOTT, Gas Manager, at Dalbeattie, has been appointed Engineer and Manager of Kirkcudbright Gas-Works in succession to the late Mr. William Balfour.

* * *

Mr. JOHN H. DANIELS, of Canterbury, has been appointed to succeed Mr. R. J. Calderwood, who will be retiring from the position of Gas Engineer and Manager to the Milford Haven U.D.C. on March 31.

Letter to the Editor

Fuel Economy in Gas-Works

DEAR SIR,—In the fifth of his interesting and instructive articles on Fuel Economy in Gas-Works, Mr. Gill puts his finger on one of the most common causes of loss of efficiency in gas-works. As he rightly points out, the loss incurred is not confined to the increased cost of steam raising, but that the effects of a poor steam supply may affect the efficiency of the whole plant.

It would be a good thing if Nos. 1 to 11 of the directions which he has set out for the instruction of stokers of hand-fired boilers were placed in every boiler-house. Enamelled notices would be best for this purpose, as they can easily be kept clean. I would suggest that items 3, 5, and 7 should be underlined in red, as these are the most difficult rules to instil into stokers who have not been accustomed to the use of coke. If carried out properly, they not only improve efficiency, but also lighten the labour of the stoker.

Mr. Gill does well to call our attention to a common source of loss of steam—*viz.*, leaks in boiler mountings and steam pipes. The use of screwed couplings in a steam pipe is a fertile source of trouble.

The remarks on the use of steam injectors for boiler feeding, to my mind, call for some qualification, as they rather suggest that an injector is a less efficient appliance than a feed pump, whereas theoretically the efficiency of a good injector is much greater than any feed pump. In districts where good soft water is on tap at a reasonable price, injectors are popular, because they require very little attention. In this, as in

other things, it is up to the engineer to use common sense, and employ the appliance that is best suited to the conditions in his district.

Had Mr. Gill stated that the majority of injectors in gas-works are inefficient, I should be inclined to agree with him.

Given a good water supply, and if properly maintained, an injector makes a most satisfactory method of feeding a boiler, but as well-conditioned feed water and well-maintained injectors are conspicuous by their absence in many gas-works, it is not uncommon to find these appliances in a most inefficient condition. It should be remembered, however, that proper attention should be given to feed pumps to keep them in good condition.

Forced draught steam jets often increase in bore, and, as Mr. Gill states, may use a large percentage of the steam generated. These jets are inexpensive, and it would be a good thing to replace them by new ones periodically, say, about once a year. It would prove a cheap insurance.

It is surprising that the use of water-tube boilers fitted with chain-grate stokers has been so slow in developing in gas-works, because they provide the only efficient method of burning breeze, and by breeze I mean from ⅜ in. or ½ in. to dust. I know that there is a popular impression that a water-tube boiler is unsuitable for fluctuating loads, but this type of boiler copes with the loads of power stations and ships, where the fluctuation of load is much in excess of anything usually met with in gas-works.

Gas-Works, Cheltenham. Yours faithfully,
March 6, 1943. R. C. MACDONALD.

B.C.G.A. North-West District

The Annual Meeting of the North-West District of the B.C.G.A. was held at Radiant House, Liverpool, on Feb. 26, and was preceded by a "Save Shipping" luncheon at which the chief speaker was Mr. Ronald Tree, M.P., ex Parliamentary Secretary to the Ministry of Information. The Chairman was Colonel W. Moncrieff Carr, O.B.E., and the guests included the Lord Mayor of Liverpool, and Lt.-Colonel Albert Buckley, D.S.O., J.P. (Chairman of the Liverpool Gas Company).

At the meeting in the afternoon Colonel Carr was re-appointed Chairman and Mr. J. D. Ashworth Deputy Chairman. Mr. Stanley Hopkinson was appointed Hon. Secretary in place of Mr. T. Haworth, who had resigned after his appointment to the Technical Advisory Board. It was reported that the Regions had elected the following members to the Management Committee:

Manchester (6):
Chairman: F. A. West (Altrincham).
Deputy Chairman: J. H. Cadman (Manchester).
Secretary: H. D. Robinson (Middleton).
Colonel W. M. Carr (U.K.), E. Parry (Oldham), T. Reynolds (Stockport).

Merseyside (5):
Chairman: C. H. Leach (Liverpool).
Secretary: S. Hopkinson (Liverpool).
H. Hopkinson (Chester), J. H. Richmond (Runcorn), H. Blythe (Colwyn Bay).

Ribble (3):
Chairman: J. D. Ashworth (Blackburn).
Deputy Chairman: J. H. Ranft (Lytham St. Anne's).
Secretary: A. H. Nicholson (Colne).

Colonel Carr referred to the vital necessity for placing the Industry in its correct perspective in the eyes of the public, and gave it as his opinion that propaganda and well-directed publicity were of greater value to-day than any other branch of the Industry's activities. It was the right of the public to know what was going on in the Industry, and those undertakings which had failed to maintain contact with their consumers would undoubtedly feel ill-effects in the future.

Speaking at the luncheon, the Lord Mayor of Liverpool said that a recent questionnaire had shown Liverpool's housewives to prefer gas for cooking.

Heating Equipment Census

More than 14,000,000 homes in the United States have central heating equipment, according to data from the 1940 Census of Housing of the Bureau of the Census, Department of Commerce. The homes with central heating represented 42.0% of the 34,144,370 occupied dwelling units for which type of heating equipment was reported.

Coal or coke was the principal fuel used for heating 54.2% of the occupied-dwelling units, while wood was reported for 22.6%, gas for 11.2%, and fuel oil or other petroleum products for 9.9%.

Steam or hot-water systems furnished heat for 7,424,844 occupied-dwelling units, or about one-fifth of all homes, and piped warm-air systems were reported for 5,725,273 occupied units, or one-sixth of the total. The number of central-heating installations is considerably less than the number of dwelling units heated with such equipment, because a majority of the dwelling units in multi-family structures are heated by one installation which serves the entire structure. Central heat from a pipeless warm-air furnace was provided in 1,193,516 homes, or 3.5%.

Almost 20 million homes were without central-heating equipment, but most of these were reported as having "heating stoves." This category includes regular heating stoves, circulator heaters with flues, and non-portable electric or gas heaters. Gas was reported as the principal heating fuel for almost 4,000,000 homes, 71.1% of which were without central heating.

Teaching of First Aid

An interesting method of teaching first aid was described by L. S. Metcalfe in a recent issue of *Gas Age*. Much, he remarked, has been done in the past in the Gas Industry to organize and maintain first-aid units, but in the present situation there is a definite need for first-aid education on a broader base. This is also true in all industries, because of the influx of so many untrained and inexperienced employees who are more likely to suffer injury on the job than those familiar with duties, and the use of equipment.

There is now available a supplementary medium for speeding up and intensifying first-aid instruction. Heretofore companies have depended upon (*a*) first-aid lectures, (*b*) text-book study, and (*c*) demonstration by the use of live models. Though fully effective, learning is necessarily slow—too slow—to spread first-aid knowledge through an organization on a wider scale, to meet the needs of wartime with its multiplied hazards and exposures.

The supplementary medium is a new Kit-set of slidefilms which bring the power of visualization, *via* the picture screen, to the service of the Industry. A slide film (or filmstrip) is a length of regular standard motion picture film, with individual pictures on each "frame" or segment. Each strip carries from 31 to 77 such pictures, each of which may be projected on the screen—like movies—in logical order. Each slidefilm deals with a single phase of first-aid procedure or practice (official data). In this new Kit-set there are 20 such productions, two of which have been produced in technicolor.

With each slidefilm goes an amplifying lecture on record—thus preserving all the advantages of the verbal first-aid talk, without the necessity for an experienced instructor. Each filmstrip or lesson also includes the use of a printed lesson guide as part of the Kit. There is in addition an instructor's manual which acts as a guide to the person conducting classes.

It will be seen that any intelligent employee after going through the course can, by the use of this combination, conduct an entire course in first aid. At intervals in the films they may be stopped and a practical demonstration made by having a live model and simple first-aid supplies on hand for demonstration.

As a rule, the first-aid department of a company has only a limited time to spread first-aid knowledge through all branches of the organization. Yet, accidents have a way of happening often when no one with proper knowledge of "what to do till the doctor comes" is on the spot, and usually time is the vital element.

On the other hand, when the majority of gas company employees have taken this course, expert knowledge is available on a wider scale which ensures prompt and proper procedure.

Economy in the Use of Plumbers' Solder

The British Standards Institution has recently issued a memorandum No. 3, January, 1943, to B.S. 219, Soft Solders PD 76. The recommendations contained in this memorandum have been approved by the Non-Ferrous Metals Control, and they will be used as a guide in the granting of licences for the purchase of tin.

The necessity of tin economy is essential and urgent, and to effect the maximum economy of tin in solder every use of solder has been reviewed, and the question of wiped joints in lead pipes, either "lead to lead" or "lead to brass," has been carefully considered. The weight of solder customarily used for making wiped joints is about 8 oz. per joint in ½-in. lead pipe, but it has been established that by other well-known methods satisfactory joints can be made using less than one-fifth of an ounce. Hydraulic and tensile tests have proved them stronger than the lead pipe and the time taken to make them is, in general, less than that required for a wiped joint.

It is therefore recommended as a wartime emergency measure that the wiped joint should not be used unless there is some special consideration which makes such a joint indispensable. The alternative joints mentioned above have been examined and agreed as accepted wartime economy measures by The Institution of Gas Engineers and the British Waterworks Association.

Copies of Memorandum No. 3 (to B.S. 219), reference P.D. 76, may be obtained from the British Standards Institution, 28, Victoria Street, S.W. 1, free of charge, on receipt of a stamped directed envelope.

Royal Visit to Northampton

The King and Queen honoured the Northampton Gaslight Company by visiting their works on March 4. They were received on their arrival by Colonel G. S. Eunson, D.L., V.D., the Managing Director; and others presented to their Majesties were Mr. H. G. Banks (Engineer), Mr. F. J. Alsop (Secretary), and Mr. N. E. Batten (Works Manager). All the Directors were present, and the pensioners and wives and families of the employees were allowed inside the works to join in the hearty greeting accorded to the Royal visitors.

Their Majesties were interested to hear of the record of service of the Eunson family, who have been associated with the firm for no fewer than 97 years. The grandfather of Colonel Eunson was the first engineer in 1824 and was succeeded by his son, the late Mr. John Eunson, J.P., M.Inst.C.E., in 1845, who served the Company 57 years. His son, Colonel Eunson, commenced his work with the Company 60 years ago. Both the King and the Queen took great interest in the plant, and asked many questions concerning the processes.

The U.S. War Production Board has added thermostats to the proscribed list of accessories to domestic cooking appliances. They are no longer allowed to be attached to cooking stoves.

The Annual Meeting of the Institution of Chemical Engineers will be held at the Connaught Rooms, Great Queen Street, W.C. 2, on April 2 at 11 a.m. It will be followed by a luncheon at 1 o'clock.

A Meeting of the Institution of Engineers-in-Charge will be held on March 27, at 2.30 p.m., at St. Bride Institute, E.C. 4, when a Paper will be read by Eng. Lt.-Cmdr. A. J. Elderton, R.N (Ret.), M.I.Mar.E., on "Waste Heat Recovery with Special Reference to Internal Combustion Engines." Visitors are welcome.

An Address entitled "Gas and its By-Products, on Active Service," was given at a recent meeting of the Ormskirk Rotary Club by Mr. R. O. Roberts, Engineer and Manager to the Skelmersdale Gas and Water Departments.

We have Received from Messrs. Ames Crosta Mills & Co., Ltd., Heywood, a leaflet describing the Simplex ejector. This leaflet gives a description of a self-contained ejector which, it is claimed, has special advantages for pumping relatively small quantities of solid-laden liquids.

The Tilling Group of public transport companies proposes to adapt 651 more buses to producer gas during the present year. Nearly a year ago ("JOURNAL," Mar. 25, p. 430) it was reported that after a series of experiments with various types of producer and different kinds of fuel the Group had for some time operated the services from two of its depots exclusively on producer gas, and on an aggregate run of over a million miles had saved approximately 136,000 gall. of imported liquid fuel. Up to the end of 1942 some 107 buses owned by the group had been adapted, and the saving of petrol had reached 415,000 gall. on a total run of 2,500,000 miles.

A Conspicuous Act of gallantry by Mr. F. I. Brady, retort house foreman at the Swan Village Works of the Birmingham Gas Department, on Jan. 2 has resulted in the award to him of the British Empire Medal (Civil Division). A steam turbine situated in a small building wrecked itself, and the man in charge was severely injured by flying debris and scalded by escaping steam. He was rendered unconscious and in a short time would have succumbed to his injuries and continuous scalding had it not been for the prompt action of Brady, who brought him to safety. Brady is 64 years of age and had just recovered from a long illness.

The Ministry of Supply has issued, through the Stationery Office, what is called the "Raw Materials Guide." It is hoped that the production of this handbook will be of assistance to business men and traders and others interested who may in the past have experienced some difficulty in finding out exactly what the law is relating to particular raw materials. So many statutory Rules and Orders have been issued that it is extremely difficult for anyone to remember them all. This new Guide tells what the raw materials are, what they do, give psarticulars of their control and of the statutory Rules and Orders that have been issued about them. It is proposed to issue monthly Addenda of any changes in controls or in procedure, in order to keep the Guide completely up to date. The Guide is issued by H.M. Stationery Office, York House, Kingsway, W.C. 2, and is also obtainable through any bookseller, price 1s. net.

It is Proposed to adapt 14 buses of the Caledonian Line to producer gas this year. The Scottish Motor Traction Company, Ltd., are making experiments in Edinburgh with producer gas, and it is expected that this Company will have one bus in service this month, others following later. Meantime some of the drivers are being trained to drive buses run by producer gas. Edinburgh Corporation have also been experimenting with producer gas, and one of their buses, driven in this way, will be on the streets in a few days. Altogether 16 buses will be converted.

The Council of the Society of Chemical Industry has decided to present to Dr. Leslie H. Lampitt at its next annual meeting the Society's Medal, which is awarded to eminent chemists who have rendered conspicuous services to the Society. Dr. Lampitt is the Chief Chemist and a Director of Messrs. J. Lyons & Co., Ltd., in whose laboratory he is in charge of upwards of a hundred chemists. Dr. Lampitt has served on the Council of the Society for many years, and has been its Honorary Foreign Secretary and is now its Honorary Treasurer. He is also Chairman of the General Chemical Council, and his work has been of great value to that Council, to the Society of Chemical Industry, and to the profession of chemistry.

The Establishment of a research laboratory in the anthracite coal region of Pennsylvania has been provided for in a Bill signed by President Roosevelt. The laboratory will be used to investigate the preparation and use of anthracite, and the development of new uses and markets.

Dividends

Alnwick.—6% on the preference shares and 4½% on consolidated stock.

Cambridge.—For the half year ended Dec. 31, consolidated "Original" stock, 5%; consolidated "B" stock, 3½%; consolidated "C" stock, 2½%, all less income-tax.

Coatbridge.—Interim dividend of 5% on the original stock, and one of 7s. per share on the shares.

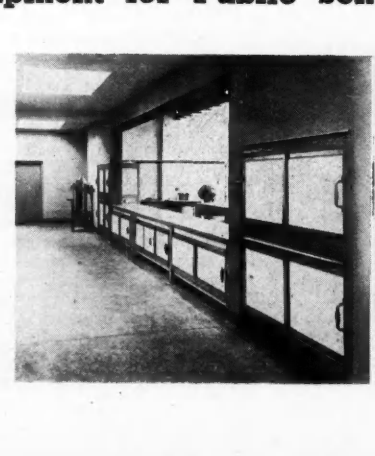
Cork.—6% per annum for half-year ended Dec. 31, 1942.

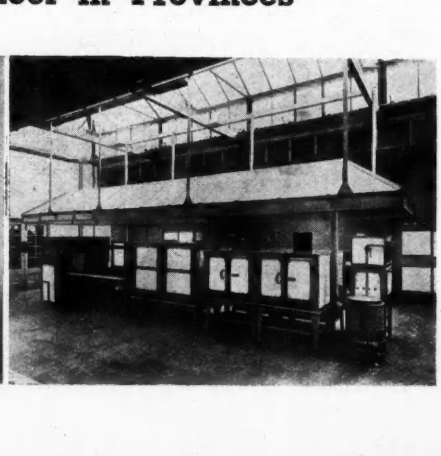
Wisbech.—12% on the original £3 stock and 11% on the ordinary £5 shares.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in the "Journal" should not be taken as an indication that they are necessarily available for export.

Catering Equipment for Public School in Provinces

Large roasting and baking ovens, boiling tables, fish fryers, steamers, &c., were supplied by Radiation Ltd., to a large public school in the Provinces. Our photographs are of the installation, which was complete with cold service counters and tabling, glass canopies, dishwashing, peeling, and mixing machines. On most days 850 meals are served.





FUEL ECONOMY IN GAS WORKS

No. 6

We are indebted to the Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd., for permission to reprint a series of notes specially compiled for them by G. M. Gill.

IN the concluding articles of the series on Fuel Economy in Gas-Works, the Author proposes to refer to certain matters which were omitted in previous articles, and to points which he considers might be stressed to advantage, with a view to efficiency.

Relative Importance of Fuel in Carbonizing Costs

In a Paper on Carbonization in Horizontal Retorts which the Author read before The Institution of Gas Engineers in 1921, he stated—and this was at a time when everything, as indeed is now the case, was very expensive during the aftermath of the last war—that each hundred pounds of expenditure in working a retort house, *i.e.*, a horizontal retort house, would be divided approximately as follows:

Coal	£68
Coke used in furnaces .	13
Upkeep	9
Wages	6
Power and incidentals .	4
	£100

While it would be interesting to compare this division of costs with those ruling to-day in large and small retort houses of various types, this is not the object of introducing these figures in this article. The object is to stress the overwhelming importance and value of fuel in the gasmaking process. As will be seen, it amounted in this estimate to £81 per £100 expended. Probably it is not greatly different to-day.

As will be noted, wages was a very small item in comparison with fuel, which suggests that it is poor economy to allow the saving of a man's wages to affect the efficient running of a works. It is therefore necessary to study the pros and cons thoroughly before coming to decisions in matters of this kind.

In the same Paper the Author stated that the cost of keeping one 20 ft. through retort at work for 24 hours was approximately £1 for fuel—*i.e.*, coke, upkeep, wages, and power. The object of introducing that point was to emphasize the high cost of maintaining a retort ready for work, highly heated, in good condition and with all the necessary labour and machinery to work it, and to stress therefore the importance of working the retort in such a way as will ensure that it turns out the maximum therms of gas and by-products per 24 hours.

Thus the importance of having the retort at the right temperature with no holes or cracks in it, with tight mouthpieces and lids, and clear ascension pipes and hydraulic main must be clear to everyone when they know that it costs £1 a day for each heated retort; and it emphasizes also the importance of putting in the right charge and for the right time, without long delays when it is opened for discharging and recharging.

Temperatures and Weights of Charges

It will be worth while referring again to some other points of which the Author has been reminded by referring to the Paper in question. Thus combustion chamber temperatures were maintained rigidly at that time within the limits of 1,280° C.–1,325° C. This is a reasonable limit, and anyone skilled in the operation of retort settings ought to be able to work to such a limit, but the Author knows from his own experience with smaller works that the variations are much greater than this. He considers that this matter is worthy of close study and attention, and that a successful result is likely to bring about improved gasmaking results in many works.

He does not suggest that this range of temperature in combustion hambers is correct for all types of plant. By no means; these were merely the temperatures observed in the South Metropolitan Works at that time with moulded siliceous retorts in use and with settings designed to suit this class of retort.

Reference was also made to the striking increase in the size of charge which can be carbonized as the result of increased temperature in the combustion chamber. These were as follows:

Weight of Charge.	Comb. Chamber Temp.	Period in hours.
10½ cwt.	1,270°C.	12
10½ ,,	1,310°C.	10
10½ ,,	1,400°C.	8

There is another matter to which reference might be made as having an important bearing upon results with horizontals, and that is the size and uniformity of charges. So often one sees charges which are too large or too small, too thick in one place and too thin in another, and as a consequence there is a loss of therms where it is too thick, and a loss of capacity in therms per retort where it is too thin; further, with the latter fault, coke has been wastefully burnt, and coal which could have been carbonized must be charged into another retort.

These faults, of course, are the results of bad carbonizing. A good manager will apply himself to the problem until he and everyone else concerned is proud of the condition of the charges—each the spit and image of all the others.

Unsealed Dip Pipes

There is another practice to which the Author referred at considerable length in this particular Paper, and that is the system of working horizontal retorts with unsealed dip pipes. Some reference has already been made to this matter in this series of articles. The Author has tried out this system on a considerable scale, and has never had any reason to consider it other than thoroughly satisfactory. He would not suggest that horizontals cannot be worked quite satisfactorily with sealed dip pipes, but he maintains that an oscillating pressure or vacuum in any retort must be a disadvantage; and that it is an advantage therefore to dispense with a seal, as in coke ovens and in vertical retorts, and also in horizontals with Congdons and anti-dips, and then rely upon modern types of governors to maintain the precise conditions required in the retorts or ovens.

A considerable change has taken place since verticals and modern coke ovens have been developed, for which efficient types of modern governors have been designed to maintain precise pressure and vacuum conditions to, say, $\frac{1}{50}$ in. in the gas collecting mains.

In the group of Companies with which the Author is concerned, about 84% of all the gas is made without any seal in the hydraulic or collecting mains, and it would seem that there is nowadays no adequate reason to perpetuate a system which results in oscillation in the retort or oven in which the coal is being carbonized.

In referring to this matter, the Author is not intending to suggest that alteration to the unsealed dip pipe system should be confined to large, well designed and new horizontal retort installations. Not at all, particularly as he believes that the maximum of advantage will accrue in the case of plant in bad condition, as working with unsealed dip pipes it is of no material importance should these be out of level. If, for instance, the dip pipes are out of level—and many are in numerous works—it is an overwhelming task to level these under war conditions, and besides, it would take a few years to deal with all the settings, nothing of course being reasonably practicable while a setting is at work.

He therefore suggests, should it be decided to employ unsealed dip pipes, that the practical steps to take, even where the conditions are definitely bad, can be summarized as follows:

Conditions to be Observed

1. The overflow of liquor from the hydraulic mains should be fixed at such a height as will ensure that the liquor will be normally maintained at, say, 1" in. below the bottom of the dip pipes. This will give sufficient space for the gas to get away without being impeded, and will be sufficiently high to permit of the dip pipes being sealed quickly should the occasion arise.

2. There must be a cock on the overflow which will be closed when the dip pipes have to be sealed, and a correspondingly higher overflow must be provided to come into operation when the dip pipes are sealed.

3. Provision must be made for the maintenance in the foul main of level gauge or of a slight vacuum or slight pressure, as may be required, to make the gas of the correct quality. This necessitates the provision of a thoroughly good retort house governor which will work with certainty to $\frac{1}{10}$ in. pressure or vacuum.

4. It is also practicable—and this method is successfully in use in two works in the Group—to use the exhauster governor for regulating the precise pressure required in the foul main. With this method it is necessary to extend the impulse pipe on the governor to the further end of the foul main, so that the exhauster governor is operated by the pressure conditions existing in the foul main itself. It need not be a large pipe, seeing that virtually no gas is actually passing along the pipe as, after all, it is merely an "impulse" pipe. In fact, 1¼ in. to 2 in. is large enough in the smaller retort houses, but the pipe must be kept clear of tar and liquor. Of the two methods the retort house governor is preferable.

5. In practice the maintenance of the correct pressure, level gauge or vacuum, in the foul mains must be such that when retort doors are open no gas will come down the ascension pipes nor will air go up. With sufficiently good governing of the conditions in the foul main this can be arranged satisfactorily.

6. Arrangements should be made to ensure that a full supply of liquor under pressure can be immediately supplied to any hydraulic main, and if and when required, to seal the dip pipes. The maximum time for this operation should not exceed 2–3 minutes.

7. Provision must be made for continuously or at least daily flushing

out all the tar in each of the hydraulic mains. No tar must be allowed to remain for any length of time in any hydraulic main.

8. When shutting down settings or in the event of breakdowns or of putting settings under slow fire, necessitating the postponement of charging retorts, it will be necessary first to reduce the vacuum, if such is being worked, to level gauge, and if the stoppage continues, to increase to a slight pressure. If the stoppage continues still further, it would then be necessary to seal dip pipes with liquor to their original depth, and then operate the retort house in a normal manner with sealed dip pipes.

9. It is important not to unseal dip pipes until at least three-fourths of the retorts in each setting are charged with coal, to ensure that plenty of gas is passing through the hydraulic main.

10. When scurfing retorts it is advisable to plug the ascension pipe, or if one or other of the ascension pipes is being used as a chimney to create a current of air through the retort, then the bridge pipe of that particular retort should be plugged.

11. Should a setting be shut down to have all the retorts scurfed or all the pipes burnt out and cleaned, then the dip pipes of that setting must be sealed.

12. A close observation should be kept on the respective pressure or vacuum in the foul main as compared with that in the various retorts, and for this purpose a few retort lids should be drilled to take a U gauge. The difference of height will in itself cause a variation and, after all, it is the conditions in the retorts which must be maintained correctly to produce the desired quality of gas. Consequently, it may be found that it is practicable to maintain a small amount of vacuum in the foul main, but possibly only when the retort doors are shut. On the other hand, it is quite likely that it will be found that the best thing to do is to work with a slight pressure or a level gauge, and never a vacuum in the retorts. A good deal depends on the condition of the plant. If it is bad, it is certain that it will be advisable to work the plant without permitting at any time a vacuum in the retorts.

13. It is a good plan to watch the ascension pipes when the doors are opened and note whether gas comes down the pipe or air is passing up. Both are wrong. The conditions should be such that no gas is coming down and no air is passing up. This is so when the desired conditions of level gauge in the ascension pipe are being observed. If a little gas comes down and burns at the bottom of the ascension pipe or a small quantity of air can be detected passing up it is of no real consequence, but it does suggest that the conditions can be improved.

14. To work this system well, a tar tower is very advantageous, but not essential. A tower provides easy means of quickly unsealing or sealing up all the dip pipes on the settings served by the tower. It must not, however, be overlooked that tower or no tower, each hydraulic main must be capable of being sealed individually as, for instance, by shutting the tar valve and arranging an overflow for any excess liquor.

15. Some managers will be nervous of creating an explosive mixture in the hydraulic main under the above conditions of working, but it should be explained that this will be virtually impossible with the setting normally at work, as the quantity of gas passing into a hydraulic main would be always so far in excess of any air which could gain admittance that there could be no danger of such an occurrence, except on occasions when charging had been stopped for some hours. As explained above, it is important at such times to seal the hydraulic main.

GAS CHARACTERISTICS

By A. J. LEATHER,
Blackburn

IN a Paper to the Manchester and District Junior Gas Association on Feb. 27 Mr. A. J. Leather, of Blackburn, gave the results of a study of the characteristics of 17 different gases extending over a wide range of calorific value, with a view to determining the influence of calorific value on the main combustion characteristics of a gas, and to ascertain how far it can be considered a reliable guide to burner behaviour. A standard method of determining the main characteristics of a gas was drawn up, and an attempt made to correlate composition with heating value in such a manner as to provide not only a more reliable basis for comparison between one gas and another in place of the present method of calorific value, but a more certain measure of the quality and behaviour of any specific gas.

The Author said: The chief items to be calculated from the composition of any given gas are gross and net calorific value, density or specific gravity, air for combustion, products of combustion, and CO_2 content of dry waste gases. The results obtained will vary with the factors used, and according to whether the gas and air are assumed to be saturated or not. It is usual for data to be calculated on a volumetric basis, but I would urge those concerned to work out the same data on a weight basis and on a thermal basis. The information thus obtained enables the utilization engineer to have a more complete knowledge of the fuel with which he is dealing, and data are established which render reliable comparison between one gas and another. The only initial tests required are those commonly made in the works laboratory—namely the number of B.Th.U. per cubic foot of gas and its volumetric analysis.

Seventeen different gases covering eleven different calorific values have been compared—actual gases that are being distributed in different parts of Great Britain, the volumetric analysis, declared calorific value, specific gravity, sulphur content, and method of carbonization in each case having been supplied by the undertaking concerned.

Observation of the figures reveals the wide difference in composition and characteristics, even of gases of the same calorific value. The percentage analyses show that, with certain exceptions, there is no wide divergency in the hydrogen content of the gases selected, although these variations can exert an important influence on flame behaviour. The percentages of carbon monoxide and methane increase and decrease respectively as the calorific value is reduced, being in almost inverse ratio, especially if the unsaturated hydrocarbons and methane are linked together.

The Gas Regulation Act of 1920 was based on the assumption that "one therm is as good as another." This has worked tolerably well, but the statement is only a half-truth, and is liable to blind us to the fact that one therm is not the *same* as another.

It is often assumed that low calorific value and high inert content go hand in hand, but figures do not support that contention. The calorific value of the theoretical gas and air mixture is practically a constant quantity and therefore independent of gas quality. It would appear that there is no direct connexion between calorific value and specific gravity, although there is a tendency for the lower quality gases to have the greatest density. The percentage of inerts has considerable influence in determining the specific gravity of any given gas.

Air for combustion and waste products can be conveniently taken together, and both show a diminution in volume and weight as the heating value is lowered.

Between very wide limits of calorific value, the amount of air required to burn one therm of gas is practically independent of the calorific value of the gas. In like manner the volume of the products of combustion from 1 therm of gas is also practically independent of gas quality.

The maximum theoretical flame temperature is rarely attained in actual practice, and then only when less air is used than is normally required for complete combustion. It is often assumed that there is considerable difference in flame temperature between gases of high and low calorific value, but figures do not bear this out. Maximum flame speed tends to increase as the heating value decreases. The lower quality gases show the greater inclination to flash back. The considerably lower value for a 200 B.Th.U. gas is apparently due to the large proportion of carbon monoxide as compared with hydrogen. The former has a flame speed of only 2 ft./sec., while hydrogen has a speed of 16 ft./sec.

The purchaser of gas equipment, especially for industrial use, relies on the sales engineer to put forward an appliance which will do the work required with economy, efficiency, and reliability. It is, therefore, particularly annoying not only to the user but to the salesman too when equipment fails to give immediate satisfaction, and burners have to be redesigned to suit the characteristics of the gas supplied by the local undertaking. This is often only effected after an extended period of experiment, manufacturers being reluctant to admit that any error has been made. Meanwhile a prejudice has arisen against the new appliance, which often takes many months to overcome. Before a furnace or similar apparatus is put in hand the makers usually enquire, "What is the calorific value?" but they often seem little interested in any further information relating to the character of the gas, it being assumed, apparently, that the burners are somewhat elastic in their ability for dealing with all qualities.

One of the factors which has influenced the investigation outlined in the Paper has been the experience of certain difficulties we have had both with air-blast and natural draught burners. The main difficulty has been the attainment of the desired temperature, and allied with it the efficient combustion of the gas to enable such a temperature to be reached. The injectors have been drilled out to suit the lower calorific value, but the increased volume passed into the furnace has not always been completely combusted without the addition of excess air, which has resulted in a lowering of flame temperature. In the case of air-blast burners, this has been overcome by installing some form of gas and air mixer to proportion and mix the gas and air prior to entering the furnace, and in the case of natural draught burners a re-designed injector and burner arrangement has in one case been necessary.

We have been informed that the same furnaces or burners have worked perfectly well on a gas of higher calorific value without special equipment, and therefore it is pertinent to ask why, with the lower calorific value, it has been found more necessary to ensure that the gas and air are intimately mixed before combustion. Is there some

other factor in the composition of the gas which should be taken into account when determining burner behaviour?

There are, virtually, three main categories of burner application available to the utilization engineer: (1) Non-aerated or luminous jets; (2) atmospheric non-luminous with either low or high pressure gas; and (3) high-pressure air or blast burners. In the first type the gas is either burned as it issues from a pipe-end, or through a series of small jets. In the second type the air for combustion is induced by the pressure of the gas in a specially designed burner, commonly described as a bunsen, but in case 3 the air is the prime mover, and is led under pressure through a burner designed to induce the requisite quantity of gas for combustion.

Whatever the method of application there are certain factors which affect the behaviour of the burner in any given case. The chief factors are specific gravity, calorific value, and air for combustion. As far back as 1913 a speaker at the annual meeting of The Institution of Gas Engineers asserted that "If the Gas Industry means to capture the large field of industrial heating, too much stress cannot be laid on the necessity of supplying a gas which has a constant density, a constant calorific value, and a constant comburivity, or ratio of air required for combustion." These remarks may well be reiterated to-day.

A number of researches have been carried out not only in this country, but in America and in Germany, in an attempt to ascertain the relationship between these factors and their influence on burner design. Researches are still being carried out to-day with special reference to flame speeds, ignition velocities, and blow-back propensities. All these investigations are related to the bunsen type of burner working on normal gas pressures. I do not know of any published researches on the type of burner common in furnace applications where pressure air is used.

There appears to have been some diffidence among gas research bodies in this country to pursue investigations relating to the mechanism of injection in burners, apparently owing to the difficulty of substantiating derived formulae in actual practice. It is suggested that an investigation into the injection effects of burners employing air as the prime mover might, as well as provide useful information for the design of pressure-air burners, throw new light on to the mechanism of combustion in the bunsen type of burner itself. It would be interesting, too, to ascertain how far the higher temperatures attainable with pressure-air are due not so much to the actual pressure of the air itself, but to the greater intimacy made possible between gas and air before combustion takes place.

Where arrangements are made to mix intimately gas and air in the correct theoretical proportions and feed to the burner under pressure, greatly increased efficiencies of utilization have been obtained, but the use of "100% mix" has to be undertaken with caution, and risks attached to its use have probably prevented its further development except in specialized applications.

It is contended that the gas characteristic which is in the nearest proportion to the orifice size is that characteristic which is likely to be the most reliable guide for burner behaviour. This must be a quality or factor easily determinable, and which does not necessitate elaborate laboratory tests or expensive apparatus. The existing measure of gas quality is the calorific value of the gas, or the number of heat units contained in one cubic foot; but as the Institution Committee of Enquiry rightly point out, "the supply of gas of a given calorific value leaves too wide an opportunity for variation in gas quality." Without abandoning heating value as a basis for gas comparison, it is put forward that a more reliable guide would be obtained by expressing heating value on a weight basis rather than a volumetric basis. That is to say, that heating value should be expressed as so many British thermal units per pound of gas, or reciprocally as so many pounds of gas per therm. The latter expression could be known as the thermal weight of the gas.

Many undertakings at the present time are increasing the production of benzole from the gas, and those who have the matter under consideration may be wondering what is going to be the effect of extraction on the behaviour of the gas under combustion. The extraction of benzole involves a reduction in calorific value as between the gas produced in the retort house and the gas that leaves the works, this amount depending upon the degree of extraction and the method of carbonization. The engineer has, therefore, the choice of either (1) increasing the quality of gas as made sufficient to balance the loss through benzole extraction, or of (2) maintaining the quality of gas as made and lowering the declared calorific value. The first course is usually adopted, partly to avoid the necessity of altering the declared value, but also because it is generally considered that an alteration in calorific value would involve difficulties with burners on the district. But this is based on assumption rather than fact. In case (1), where the quality of gas made is increased, there is invariably a reduction in specific gravity. This reduction is still further increased through the extraction of benzole, with the result that gas sent out has considerably altered combustion characteristics. Although the calorific value is the same as before, the heating value per pound has been reduced. In case (2) the only reduction in density is that due to the benzole extracted, and this is counterbalanced by the reduction in calorific value. It will be found, therefore, that any alteration in heating value per pound is small compared with case (1), and if the composition is taken into account when determining orifice size, it will be found that there is little need for burner alteration on the district.

This contention is borne out by some figures given in the William Young Memorial Lecture for 1941, where Mr. Dean Chandler gave the gas composition before and after benzole extraction was introduced, the calorific value being reduced from 560 to 530 B.Th.U., stating that the altered characteristics had no effect on burner performance. No ejectors, which were all of the fixed type, had to be altered.

The following were the figures given in the lecture:

Calorific value	560	530
Volumetric analysis: H_2	53.6	54.1
CH_4	27.9	28.2
CnHm	3.4	2.4
CO	6.8	6.9
CO_2	1.6	1.6
N_2	6.5	6.6
O_2	0.2	0.2
Specific gravity	0.40	0.373

The following calculations have been made based on formulae enumerated in the present Paper:

Calorific value per cu.ft.	561.4	531
Density, lb. per cu.ft.	0.0304	0.0292
Specific gravity	0.401	0.384
Heating value, B.Th.U. per lb.	18,450	18,160
lb. of gas per therm	5.42	5.51
Orifice area per 100 cu.ft. using expression $0.355 \frac{Wt}{X}$, where Wt. = lb. of gas per therm, and X = $H_2 + CO + N_2 - 8.5$	0.0329	0.0331
Orifice area for 20 ft. burner	0.00658	0.0066
Drill size	42	42 in.
Air for combustion per cu.ft. of gas	4.938	4.883
" " per lb. of gas	1,624	1,672
Port area per 100 cu.ft. of gas using expression $\frac{20\ Ap}{X} \times$ Orifice Area, where Ap = cu.ft. of air required per lb. of gas consumed, and X = factor based on composition, as above	1.832	1.873
Port area for 20 ft. burner	0.366	0.374
Drill size	11/16	11/16 in.

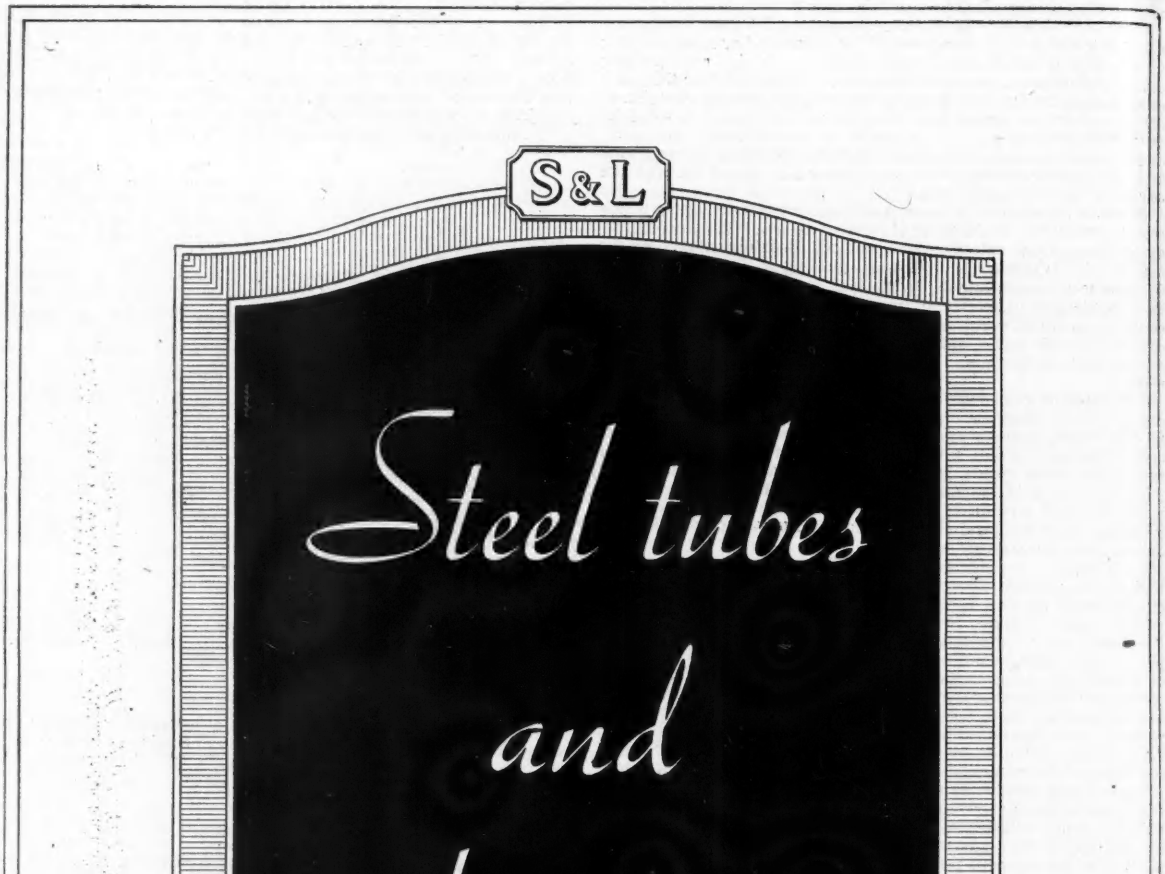
From the above it can be shown that although the calorific value reduction amounted to 5½%, the reduction in heating value per pound was only 1½% and the orifice size was unaffected. This confirms the experience obtained on the district.

Conclusions

Within the limits of the 17 gases under review it is shown that calorific value, as declared by gas undertakings, has little relationship to the main combustion characteristics of a gas, and may be a false guide to burner behaviour and burner design. The need for a standard method of assessing these characteristics is pointed out, and their evaluation in the gases under review may tend to correct preconceived notions relating to the anticipated behaviour of gases of differing quality. It is contended, however, that heating value can be a valuable guide in gas utilization, but it must be expressed in terms of weight rather than volume. The main reasons for expressing heating value per pound in place of per cubic foot may be summarized as follows:

1. It is more in accordance with general scientific practice, and a more direct comparison can be made with the calorific value of other fuels.
2. It gives the gas manufacturer greater elasticity in gasmaking. At present, of the two factors, calorific value and specific gravity, only the latter is variable (although wide variation in this factor is undesirable), whereas with heating value on a weight basis both factors are variable, providing the number of heat units per pound remains undisturbed.
3. It is a closer guide to burner design than calorific value per cubic foot.
4. It should enable the appliance manufacturer to design equipment with greater certainty of reliability in performance when used with any particular gas.
5. It is simple, easily determined, and avoids complicated formulae.

The British Commercial Gas Association in co-operation with the National Catering Service of the Empire Tea Bureau has prepared a brochure entitled "Planning for Industrial Catering" for the guidance of those setting up canteens. It contains plans and perspective drawings of kitchens of various sizes, together with specifications of suggested equipment. The kitchen layouts conform to the requirements of the Ministry of Works and Planning and the equipment follows the Ministry's Schedule of Types for Wartime Supply. The necessity to conserve paper at the present time has made it impossible to produce this brochure in sufficient quantities for general distribution. Two copies, however, have been sent to each Industrial Gas Development Centre, and gas undertakings will have copies which can be consulted by enquirers interested in canteen installations.



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PROXIMATE ANALYSIS OF COAL*

By JOSEPH BROWN, M.Sc., and ALAN S. BEAN, M.A.

(*Continued from p. 284*)

It is a splendid base on which to build up any modern classification using the latest information, and can be regarded as a broad, easily assimilated "Everyman's Guide to Coal."

Looking over the Table we should like to draw your attention to several important features. The first is that as the coals progress from the lignites to the anthracites, the percentage of carbon (not fixed carbon) shows a steady *increase*, more or less in step with a steady *decrease* in the volatile matter. The hydrogen sets out fairly high in the lignites, reaches a peak somewhere in the bituminous coals, then falls off sharply towards the anthracites. The coking properties set out by being non-existent in the lignites, work up to a maximum in the lower volatile range of the bituminous coals, and fade away altogether as the anthracites are reached.

Another very able classification of coal is that due to C. A. Seyler.† We cannot do justice to it here, but refer you to his original writings. Briefly the coals are divided into the well-known broad groups by means of their hydrogen (M.A.F. coal). Against the hydrogen is set the carbon, with the interesting revelation that for any given range of hydrogen, the coals will sub-classify themselves according to the carbon. This scheme is diametrically opposite to that of Regnault-Grüner-Bone, who work in terms of carbon as the main classifying characteristic, with hydrogen and volatile matter as the sub-classifiers. From the scientific point of view Seyler's classification has, of course, everything to recommend it, but the coal trade as a whole thinks in terms of volatile matter, and also the names are rather complicated for general use. Albeit there are several good round names that must be perpetuated in any popular scheme of coal classification. The principal of these is "carbonaceous," which exactly fits a group of coals lying between the semi-bituminous and the anthracites. They are distinguished by low volatile matter—about 10 to 16%—and coking properties more or less completely absent. The utilization of the carbonaceous coals can only be for combustion purposes.

The Seyler classification has also the virtue of finding a comfortable pigeon-hole for the cannels and the bastard cannels (so-called because of the high illuminating quality of the gas they yield—*i.e.* candle coals). The true cannels are distinguished by their high volatile matter (over 40% M.A.F.). The bastard cannels have somewhat lower volatile matter—over 36% M.A.F. These bastard cannels have a hard slaty appearance and feel, but give terrific gas yields. We often receive samples, sent in as slate by way of complaint, so much so that the astonishing results of the carbonization assay no longer come as a shock, and our replies have almost degenerated into routine.

How far can we go in predicting industrial performance of a coal from its proximate analysis?

Here we have to be cautious because much will depend on the frequency with which the analyses are carried out, and the fewer the analyses the greater the likelihood of false predictions. We feel it really essential to emphasize at this point that information of the greatest value can *only* be obtained by consideration of a series of analyses of any given coal. Too much reliance should never be placed on individual analyses. During the operation of plant the quality of the coal is not the only factor. Equally important are the personnel who operate the plant, and as time goes on they become of increasing value by reason of what they have learned. If supplied with frequent proximate analyses they will soon be masters of the figures that fit in best with their method of working. Any coal lying outside the range they prefer will be noticed at once. When the selection of a substitute is more or less compulsory it is asking a great deal of the proximate analysis, if we expect it to do this unaided by any other tests. The proximate can be used to select a number of likely coals; then all possible additional tests should be used to settle the various characteristics—one at a time.

The amount and the colour of the ash will tell us quite a lot. The red ash coals will give a non-dusty domestic fire, but they will fuse with some readiness under industrial conditions. Coals with ash of light colour will, in general, prove to be infusible under industrial conditions, but perhaps be very dusty in domestic use. With constant practice one can *roughly* predict the melting-point of the ash from its appearance, but this can never be a substitute for an actual fusion test which, after all, is quite a straightforward job. Even then, an actual determination of the fusion characteristics of the ash should not be taken as final evidence that the coal will or will not form clinkers, since the ash made in the laboratory is an intimate mixture of all the ingredients of the coal, whereas under working conditions much of the mineral matter will be in separate pieces, each a law unto itself.

An important figure to keep in mind is 1350°C. for the fusibility of coal or coke ash. An ash that has shown no signs of fusion at this temperature when heated in the standard semi-reducing atmosphere can, in general, be relied on to behave well in use. (The semi-reducing atmosphere gives minimum fusion points.) It is our custom to take the ash to 1400°C. and there to stop. On the Continent 1350°C. is the figure always stipulated for fuel intended for central heating, which is in widespread use.

Coals with ash fusing below 1350°C. can give clinkering troubles and their use for certain purposes should be avoided. Even under such gentle conditions as obtain in ordinary hand-firing, coals with ash fusing in the very low ranges can give trouble unless handled with a care that is beyond the patience of the average fireman. It must be remembered, however, that the formation of clinkers does not, by itself, in any sense of the word, constitute "trouble." Real clinkering trouble causes the formation of very large blocks of molten ash often containing much unburned fuel, which rapidly reduce the draught below the margin required to maintain a useful head of steam. Very often these large blocks melt and lock themselves on to the firebars or other fittings, with disastrous results. For combustion, the mastery of the draught must always remain in the hands of the fireman and must never be allowed to pass to the fuel.

If excessive iron oxide be an undesired feature of the ash this should be decided by chemical analysis of the ash, except where the colour is so very red that high iron oxide is self-evident. This same redness can often be taken as evidence of the presence of much iron pyrites—brasses, iron sulphide, FeS_2—and this should lead back to a determination of the sulphur, for this may well be excessive. Sulphur burns to sulphurous and sulphuric acids and may be the cause of considerable damage. In the carbonization industries sulphur passes partly into the gas, where it has to be sought and removed, and partly into the coke, where once again it is most unwelcome.

The quantity of the ash is, of course, of supreme importance, and when unduly high should lead back to a determination of other properties, such as the calorific value and the carbonization assay to discover how far they have been affected. For certain makes of mechanical stokers it is even necessary to be sure that the ash is not too low.

The "air-dried" moisture can tell us something about the type of coal, for they may be grouped into those of high combined moisture and those of low combined moisture. Taken in conjunction with the "as sampled" moisture it can be ascertained whether a coal has been wetted either underground or at some subsequent stage of production, preparation or transport. The "de-watering" of washed coals will be indicated by the "as sampled" moisture. May we, however, at the risk of being tedious, again remind you of the inseparable connexion between the "as sampled" moisture and the weight of the consignment.

The volatile matter—especially the moisture and ash-free volatile matter—together with the coke residue, speaks volumes. This is especially so at coke ovens attached to collieries, and in the carbonization industries generally, where regular supplies of the same coals are used. While any suggestion to use coke buttons from the proximate analysis as a means of distinguishing between coals that are very similar is, to say the least, futile, there remains the fact that coals which are abnormal or "off the run" may stand out very clearly. This should lead immediately to a complete overhaul of the coal. If there has been a serious error in deliveries it may be a wise precaution to re-sample the coal as as "to make assurance doubly sure."

The carbonization industries also use the volatile matter for the control of blending, the object being to charge ovens or retorts with as nearly constant a coal as is possible so as to ensure uniform working. The swelling of coal during carbonization can also be controlled by blending highly swelling coals with coals of lower swelling power, and the proximate analysis in one form or another is used very extensively for this work.

For both coke ovens and gas-works the gas yield is of great importance, and a useful control figure is the gas yield expressed as gaseous therms. Coals yield up to over 14,000 cu.ft. of gas per ton when undergoing "straight" carbonization—that is to say, when there are no complicating features, such as steam or air blasts designed to gasify part of the coke. The calorific value of the gas will vary from about 900 B.Th.U. per cu.ft. downwards, depending on the method of carbonization. The high calorific values are obtained in low temperature carbonization, while the gas-works and coke-oven gas will be from about 620 down to about 500 B.Th.U. per cu.ft. At coke ovens the yield of therms generally lies between 60 and 70 therms, while for gas-works a minimum of 70 should be obtained, with the best of them yielding over 75 therms per ton in "straight" carbonization. The therms per ton obtained in the carbonization assay can be calculated to M.A.F. coal, in the same way as was done for the volatile matter, and the result so obtained can be used as an indicator of the trueness to type of a gas or coking coal. For a given coal the M.A.F. therms can be used to make approximate calculations of the potential gas yield from the proximate analysis. We use a further figure, which is—

$$\frac{\text{M.A.F. therms}}{\text{M.A.F. volatile matter}} = \frac{T}{V}$$

and find that this figure is reasonably constant for any one coal. We also find that so far as the bituminous coals are concerned T/V steadily increases as the volatile matter diminishes. It is hoped to publish more of this later.

(*To be concluded*)

* From a Paper to the Institute of Fuel, Feb. 18.

† *Fuel in Science and Practice*, **3**, i, 5-16, &c.

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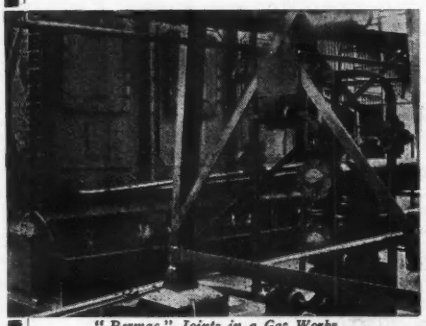

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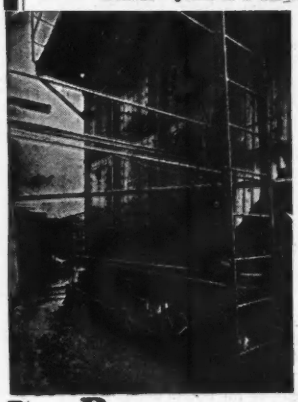

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Products Prices—Stocks and Shares

The London Market Mar. 8.

The chief item of interest in connexion with the Coal Tar Products market is the issue of a new Government Order, the Coal Tar Products Prices Order, 1942 (S. R. & O., 1942, No. 2509), which came into force on Jan. 1.

All Coal Tar Products are in good demand, and Pitch in the London area remains about 45s.

The Provinces Mar. 8.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 90's, 1s. 10d., pure, 2s. 5d. (controlled by the Control of Toluene No. 2 Order, July 3, 1941, which fixes the maximum price at which this material may be sold). Naphtha and Xylol controlled by the Coal Tar, Naphtha and Xylol Order, 1942, dated Dec. 7, 1942, and operative from Dec. 21. Carbolic acid, 60's, naphthalene, and anthracene controlled by the Coal Tar Products Prices Order S. R. & O. 2509, dated Dec. 7, 1942, and operative from Jan. 1, 1943. Filtered heavy oil (min. gr. 1,080), 7½d. to 8d. Creosote oil has been generally controlled as to direction and price for some time past. Current value—fuel grades 5d. to 5½d.; timber preservation and other purposes 4¾d. to 6d.

* In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of the "JOURNAL" for Sept. 10, 1941.

Tar Products in Scotland Mar. 6.

There is no change to record. Refined tar controlled. Value is 4½d. per gallon *ex* Works, naked. Creosote oil: Specification oil, 6½d. to 7d.; low gravity, 7¼d. to 7½d.; neutral oil, 6d. to 6½d.; hydrogenation oil, 5⅞d. per gallon; all *ex* Works in bulk. Refined cresylic acid is 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha, 6½d. to 7d. per gallon. Solvent naphtha: Basic prices delivered in bulk, 90/160 grade 2s. 8d., and 90/190 Heavy naphtha, Unrectified, 1s. 10½d.; Rectified, 2s. 3d. per gallon. Pyridine: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

A firm tone characterized stock markets generally last week. Home railway stocks and diamond shares were strong features although the strength of the former was not maintained throughout. Business in gas stocks and shares was about on a par with that of the previous week and any price changes were in an upward direction. The only exception last week was a sharp drop of 15 points in Alliance and Dublin Ordinary to 85. Among the best increases were the 4% preference shares of Associated Gas and Water with a rise of 1s., and Plymouth and Stonehouse ordinary which closed 7 points higher at 79½. On the Provincial Exchanges Newcastle units were in demand and the quotation was moved up 9d. to 23s. 3d. A parcel of £5,000 South Metropolitan 6% preference is on offer at 122 to yield £4 18s. %, and since dividend payments on this stock were resumed for 1942 a holding may prove a profitable investment.

The following price changes occurred during the week:

OFFICIAL LIST

Alliance & Dublin	80—90	−15
Associated Gas & Water 4 p.c. Cum. Pref.	17/—18/−	+1/−
Brighton, Hove & Worthing Cons.	77—82	+2
Gas Light 3½ p.c. max.	64—67	+1
Montevideo Ltd.	95 – 100	+2
Plymouth & Stonehouse	77—82	+7
Primitiva Holdings	12/—14/−	+−/6d.
Severn Valley 4½ p.c. Pref.	17/6—19/6	+−/6d.
South-Eastern Gas Corporation Ord.	17/9—18/9	+−/3d.
Ditto 4½ p.c. Cum. Pref. (*x.d.*) ...	18/—20/−	Mar. 1
Ditto 4 p.c. Cum. Pref. (*x.d.*) ...	15/6—17/6	"
Tottenham Ord. (*x.d.*)	100—105	"
Ditto 5 p.c. Pref. (*x.d.*)	97—102	"
Wandsworth 4 p.c. Pref.	87—92	+2

SUPPLEMENTARY LIST

In the Supplementary List published in the "JOURNAL" of March 3, the quotation of Southampton 5% Debenture should have read "103—108," and that of Tottenham 5% Reg. Red. Mortgages "99—102."

PROVINCIAL EXCHANGES

Derby Cons. (*x.d.*)	122—127	Feb. 8
Great Grimsby "A" Ord. (*x.d.*) ...	155—165	Feb. 22
" " "B" Ord. (*x.d.*) ...	155—165	"
" " "C" Ord. (*x.d.*) ...	145—155	"
Liverpool Ord. (*x.d.*)	103¾—104¾	"
Newcastle Units	23/—23/6	+−/9d.
Preston "A" (*x.d.*)	150—160	Feb. 8
Sheffield Ord. (*x.d.*)	129—132	Feb. 22
Sunderland max. (*x.d.*)	112—113	"

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